

State of Alaska

Alaska Energy Authority

Grantee: Kotzebue Electric Association, Inc.
Project Name: Kotzebue Electric Heat Recovery ECR
AEA Contract No.: 2195222

Project Completion Report

December 18, 2006

Project Overview

Kotzebue Electric Association, Inc. (KEA) is a rural electric cooperative in Kotzebue, Alaska. Kotzebue is a remote, isolated community of approximately 3,500 people located 33 miles north of the Arctic Circle on the Northwest coast of Alaska.

KEA uses jacket water (secondary heat) heat from diesel generator sets in their power plant to heat the company offices, fuel system and warehouse. The heat is also used to operate an icemaker in the summer for the commercial fishing fleet.

This project will significantly increase the use of the secondary heat from the power plant, reduce emissions and improve the fuel efficiency of the power plant.

KEA's increasing use of secondary heat and fuel conservation measures are a reflection of our continuing commitment to lower electricity costs, reduce environmental risks associated with using diesel fuel, increase self-reliance and promote responsible energy development in Northwest Alaska.

KEA has also been utilizing wind energy since early 1993. As a result it has saved \$120,000 in annual fuel costs. At the present time KEA has 16 wind turbine generators operating with one more to be installed in early 2007. KEA will be looking for further

funding to increase the capacity of wind generation to further lower diesel consumption and also lower the electric rates to customers.

Project Description

The goal of the Kotzebue Heat Recovery project is provide heat to the City of Kotzebue's potable water distribution system using secondary heat from the KEA power plant.

The first step was to extend one of the City's four potable water distribution loops into the KEA power plant where secondary heat from the generators is added (see Figures 1 through 6 below).

Heat is added to the City water from the engine jacket water cooling system and from the engine after-cooler system via two Alfa-Laval double-wall heat exchangers as shown in Figure 7. Double-walled heat exchangers are used to maintain two barriers between the ethylene glycol in the KEA power plant and the City water. The heat exchangers are placed in series on the City water line.

Regulation of the heat added to the City water by each system is accomplished using variable speed driven pumps shown in Figure 8. The amount of energy added to the City water is measured by a calibrated and certified BTU meter seen in Figure 9. The BTU meter provides the data needed for billing purposes to the City.

The City of Kotzebue is billed by KEA for energy absorbed by the water system. The cost per BTU is based on the current price the City pays for heating fuel.

Following are the figures noted above and a discussion of the project results.



Fig. 1. Four underground valves were added at the existing water main to begin the extension to KEA. The four valves were added at a location where a leaking mechanical joint had existed. By using HDPE electro-fusion couplings to connect the valve assembly to the existing line the risk associated with leaking mechanical couplings was eliminated.



Fig. 2. New arctic 8" HDPE water lines extending to KEA. The four, 8" HDPE ball valves allow isolation and bypass modes in case of a loop freeze up. Approximately 1300' of new line was installed.



Fig. 3. New City water lines approaching KEA power plant on left of figure. Routing the new water lines into the plant became challenging near the power plant as several other piping systems are buried in the vicinity.



Fig. 4. City water line being extended into the KEA power plant. Contractors fusing 8" HDPE elbows to pipe. Incoming cool water is on the right and heated water on the left. Flow through the line was initially 100gpm but increased to 200gpm during the summer of 2006.



Fig. 5. 8" City water lines entering the power plant at the west-side wall. An auxiliary hot-water heat exchanger had to be removed at the location where the City lines entered the plant. The water enters the KEA plant at a central location, allowing for future connection of a fire hydrant connection for plant fire protection.

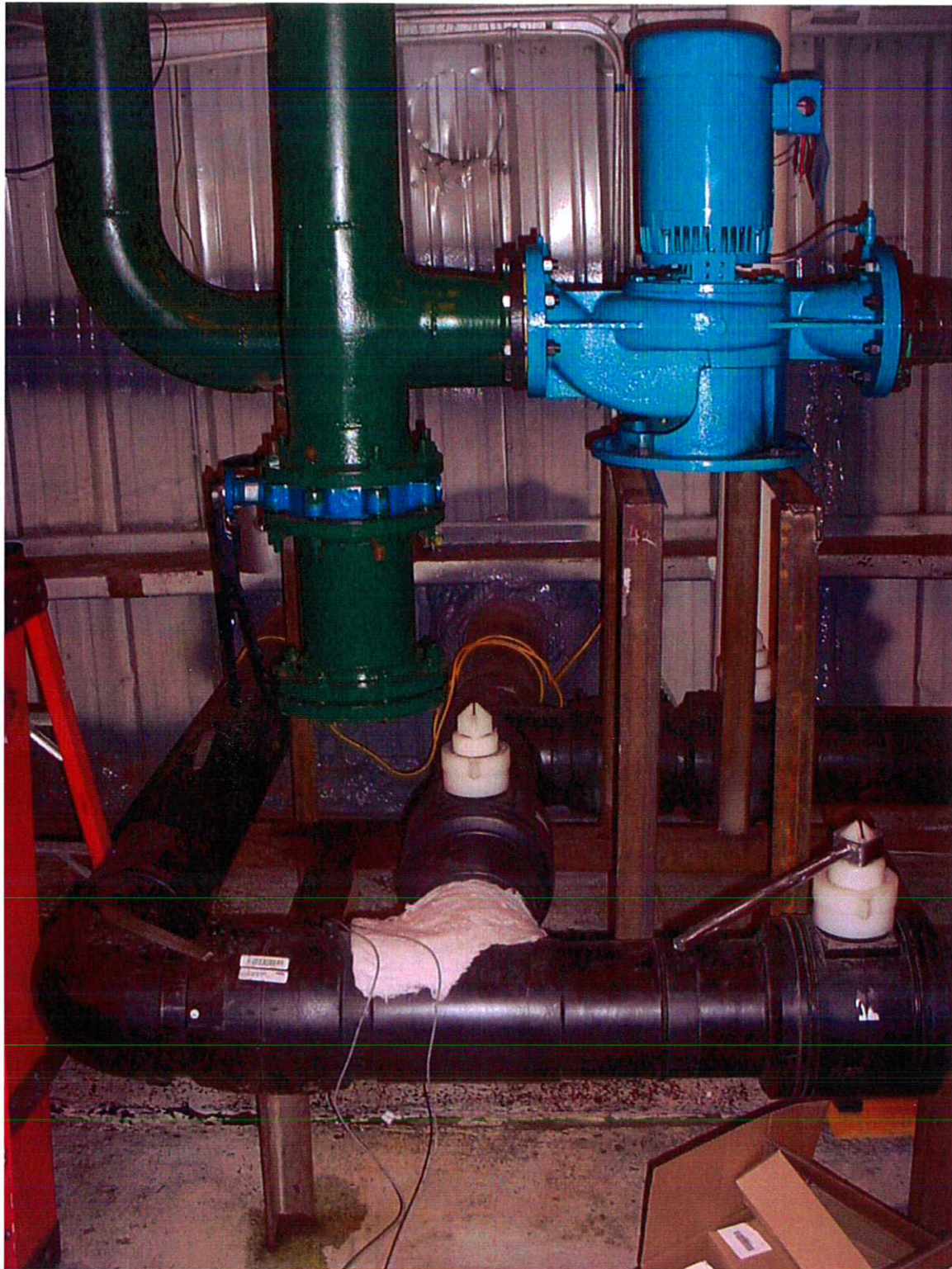


Fig. 6. Completion of the City water line into the KEA power plant. 8" HDPE isolation and bypass ball valves are used for in the plant as well.

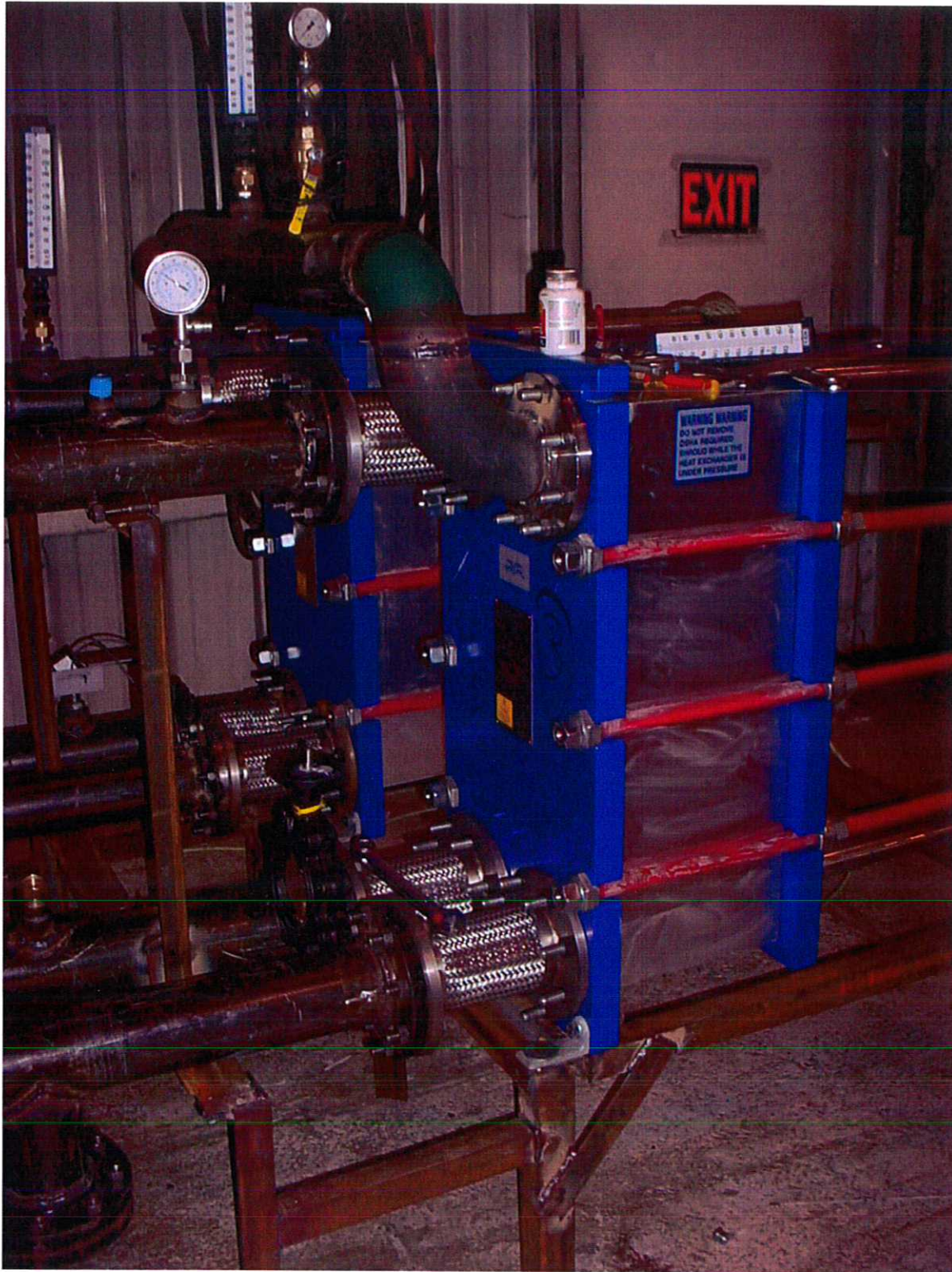


Fig. 7. The two Alfa-Laval, double-wall heat exchangers connected to the City water and the two heat sources (after-cooler and jacket water).



Fig. 8. Each heat source has a variable speed pump to add heat to the City water system. Jacket water heat is added via the larger blue pump and after-cooler heat added by the smaller black pump.



Fig. 9. BTU (energy) meter as installed on side of system controller. Typically water enters KEA at a temperature of 36-40 degrees Fahrenheit and is heated to 65 degrees Fahrenheit.

Project Results

All work has been completed on the system and is operating successfully as designed. In addition, KEA is working with the City of Kotzebue to further utilize the secondary heat available from the power plant to heat raw water entering the City's water treatment plant. The raw water is pumped from lakes 2 miles east of town and usually arrives at the water treatment plant at 34 degrees Fahrenheit. Heating the raw water would eliminate the need for any boiler-fired heating of the City water system except for at the source where the water is heated by a boiler minimally in January and February). With warmer raw water, smaller quantities of chemicals are needed to treat the water, which is a cost saving to the City.